

REMARKS

Applicants appreciate the thoroughness with which the Examiner has examined the above-identified application. Applicants have endeavored to amend the application in a sincere effort to overcome the objections and rejections. Reconsideration is requested in view of the amendments above and the remarks below.

The present amendment is prepared in accordance with the new requirements of 37 C.F.R. § 1.121. The clean copy of the claims is provided above. The marked-up copy of the claims is attached on separate sheets. In the marked-up version, inserted material is underlined and deleted material has a line therethrough.

Applicants note that the Restriction Requirement has been reconsidered and that the claims of Group I now include claims 1-28 and Group II, claims 29-30. Claims 29-30 have been withdrawn from further consideration by the Examiner and claims 1-28 are pending in the application. Applicants have canceled restricted claims 29-30.

Claims 1-11, 16, 18, 25-28 have been rejected under 35 USC 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. The Examiner has noted a number of terms in the above claims which are objectionable and Applicants have amended the claims as requested and it is respectfully submitted that the claims are now proper under 35 USC 112, second paragraph. No new matter has been added.

Claims 1-28 have been rejected under 35 USC 103(a) as being unpatentable over Li (U.S. Patent No. 5,603,849) in combination with Matthews (U.S. Patent No. 5,911,837) or Berbel (U.S. Patent No. 5,989,359) and Squires et al. (U.S. Patent No. 4,619,706).

Li is cited as teaching a method and composition for cleaning silicon wafers in a two-phase liquid system, noting the Abstract. The reference teaches the etchant, the at least two fluids of different densities and also teaches using nonpolar organic liquids which are selected from the group of consisting of ketones, ethers, alkanes and alkenes, citing column 3, lines 10-67, and columns 4-6, and the claims.

The Examiner acknowledges that Li does not teach passing the article through at least one fluid interface horizontally, or at any other interface, the vessel, removing water, and the agitation as claimed.

Matthews is cited as teaching a process for the treatment of semiconductor wafers in a fluid and the reference teaches a vessel, the drying, and two fluids as claimed. Berbel is cited as teaching a method for drying objects with fluids. Squires et al. is cited as teaching a method of stripping organic coatings from substrates using a two-phase fluid and agitation.

The Examiner concludes it would have been obvious for one skilled in the art to use the vessel taught by Matthews and the agitation taught by Squires et al. in the Li process to obtain the claimed process. The Examiner contends that because all the references are from the same technical endeavor, which is a method of preparing a substrate by using two-phase fluids, that one skilled in the art would use the drying taught by Berbel or Matthews in the Li process to obtain the claimed process. The Examiner further concludes that this is because it is well known in the art to use two-phase fluids for removing water or liquid from the surface of a substrate.

It is respectfully submitted that claims 1-28 are properly allowable over the above combination of references.

Before we review the rejections in detail, it may be helpful to set forth Applicants' invention as now claimed. Applicants are claiming a method of preparing an article surface wherein at least two fluids of different densities are used such that a fluid interface exists between each fluid. An article is provided with one or more reactive components on the surface which components have a greater affinity or solubility to one of the fluids. The article is positioned in one of the fluids and the article is then treated by passing the article through the fluid interface.

All the claims in the application are directed to a method and all the claims require that a fluid interface exists between the fluids through which the article passes to prepare the article surface and that the reactive components on the surface have a greater affinity or solubility to one of the fluids. It is respectfully submitted that the prior art references do not show Applicants' invention whether taken singly or in any proper combination thereof.

The Li reference discloses methods and compositions for cleaning oxides and metals on surfaces of silicon wafers in a two-phase liquid system. The two-phase system utilizes a fluorine containing oxide etchant that is soluble within two immiscible liquids of different densities which two liquids form separate layers. The silicon wafers are immersed into the top layer which is a non-polar organic liquid. The bottom layer is a polar liquid preferably water. Metal ions are transported from the surfaces of the silicon wafers through the organic top layer to the polar or the bottom layer thereby eliminating metal ions from the organic layer. Due to relative solubilities, the concentration of

fluorine etchant in the water bottom layer is greater than in the organic top layer. The differences in concentration of the fluorine etchant in each phase extends the lifetime of the system since the fluorine etchant in the water bottom phase is transported by equilibrium forces to the organic top layer as the etchant is consumed in the top layer due to cleaning oxides from the surfaces of the silicon wafer positioned in the organic phase.

It is clear and the Examiner acknowledges that Li does not teach passing the article through at least one fluid interface as claimed by Applicants. This is an important feature of Applicants' invention which, as discussed above, requires in all the claims that the workpiece or article be passed through at least one fluid interface to treat the substrate. Li is deficient in this teaching and it is respectfully submitted does not disclose nor teach Applicants' invention. It is clear that Li is using the two-phase system to establish a diffusion type equilibrium with the etchant which is continually being replenished in the organic phase as the etchant is used in the organic phase to separate metal ions from the surface of the silicon wafer. Li does not teach nor disclose passing the articles through the fluid interface.

The Matthews reference is directed to a chemical solvent drying process for semiconductor wafers which are submerged in an aqueous rinsing bath. An organic drying solvent is provided having a density less than water and is added to the bath and forms a lower aqueous layer and an upper organic layer system. The wafer is entirely submerged in the lower aqueous layer and the wafer lifted up from the lower aqueous layer through the upper organic layer and then evaporation drying the wafer. There is no

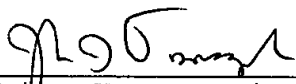
disclosure in Matthews to remove reactive components on a surface using two fluids one of which has a greater affinity or solubility to the reactive component.

Berbel is also directed to a method of drying objects with fluids wherein an object to be dried is placed in a container and a first fluid introduced into the bottom of the container. A volatile second fluid is then introduced into the bottom of the container and the volatile second fluid has a specific gravity greater than the first fluid and is not miscible with the first fluid so that a stable interface is formed between the two fluids. The second fluid is continued to be added and pumped until some of the second fluid exists the top of the container and then the remainder of the second volatile second fluid is drained from the container and the volatile second fluid allowed to evaporate from the object. This reference is similar to Matthews in that it relates to the drying of a wafer.

Squires et al. is directed to a di-phase stripping composition wherein an aqueous phase has a non-aqueous solvent phase dispersed therein. As noted in the patent at column 6, the paragraph beginning at line 61, it is essential to maintain a good dispersion of the solvent phase in the aqueous phase during the time the coated substrate is in contact with the stripping bath. Basically, the two-phase liquid bath is agitated to maintain a relatively uniform dispersion of the organic phase in the aqueous phase. As noted in Example 1, the coated cast parts were contacted in the stripping bath at a rolling boil at 220°F for approximately one hour and then the stripping composition removed. This is not Applicants' method which requires a fluid interface between each fluid in which the article to be treated is passed through the fluid interface.

It is respectfully submitted that the application has now been brought into a condition where allowance of the case is proper. Reconsideration and issuance of a Notice of Allowance are respectfully solicited. Should the Examiner not find the claims to be allowable, Applicants' attorney respectfully requests that the Examiner call the undersigned to clarify any issue and/or to place the case in condition for allowance.

Respectfully submitted,




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CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service on the date indicated below as first class mail in an envelope addressed to the Assistant Commissioner of Patents and Trademarks, Washington, D.C. 20231.

Name: Carol M. Thomas Date: December 16, 2002 Signature: 
ibmb100270000amdA

VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Claims

Claims 29-30 have been canceled without prejudice.

Claims 1, 11, 12, 16, 17, 18, 24, 25 and 26 have been amended as follows.

1 1. (Amended) A method of preparing an article surface comprising the steps
 2 of:
 3 providing at least two fluids of differing densities such that a fluid interface
 4 exists between each fluid layer;
 5 providing ~~one or more~~ an articles with one or more reactive components on a
 6 surface of ~~one or more of the~~ articles having a greater affinity or solubility to
 7 one of the at least two fluids;
 8 positioning the ~~one or more~~ articles into one of the at least two fluids; and
 9 treating one or more of the reactive components on the article surface by
 10 passing the article through at least one fluid interface vertically,
 11 horizontally, or at any other orientation.

1 11. (Amended) The method of claim 1 wherein the ~~step of providing~~
 2 ~~an~~ positioned article ~~with a reactive component, the reactive component having a~~
 3 ~~greater affinity or solubility to a fluid having a higher density than another of the at~~
 4 ~~least two fluids, and wherein the step of positioning the article into the at least two~~
 5 ~~fluids comprises positioning the article into the at least two fluids with mixing is~~

mixed at an elevated temperature and further including the steps of ceasing the mixing at an elevated temperature and cooling the fluids such that the fluid having a higher density with an affinity for the reactive component settles and passing the article through the fluid interface.

12. (Amended) A method of preparing a workpiece surface comprising the steps of:

providing a reaction vessel having a first inlet/outlet means located at a bottom of the vessel and a second inlet/outlet means located above the first outlet means;

providing a first fluid into the reaction vessel;

providing at least one other fluid into the reaction vessel, the at least one other fluid having a higher density than the first fluid such that a fluid interface exists between ~~at the first fluid layer~~ and ~~an the~~ at least one other fluid ~~layer~~;

providing a workpiece having a surface component having a greater affinity or solubility to either the first fluid or the at least one other fluid;

submerging the workpiece into the reaction vessel having the first fluid and the at least one other fluid such that the workpiece is below the fluid interface;

treating the surface component by passing the workpiece through the fluid interface; and

terminating the treating step.

1 16. Amended The method of claim 15 wherein the treating ~~step of terminating~~
2 ~~the processing step~~ comprises lifting the workpiece through the fluid interface into
3 the first fluid which has substantially no affinity for the surface component.

1 17. (Amended) The method of claim 12 further including the step of heating
2 the first fluid and at least one other fluid into solution after submerging the
3 workpiece into the reaction vessel such that upon cooling, the first fluid ~~layer~~ and
4 the at least one other fluid ~~layer~~ are immiscible with the fluid interface present and
5 the ~~surface component~~ workpiece is substantially present in only one of the fluid
6 layers.

1 18. (Amended) The method of claim 12 further including the step of agitating
2 the first fluid and the at least one other fluid after submerging the workpiece into
3 the reaction vessel such that upon ceasing agitation, the first fluid ~~layer~~ and the at
4 least one other fluid ~~layer~~ are immiscible with the fluid interface present and the
5 surface component is ~~substantially~~ present in only one of the fluids ~~layers~~.

1 24. (Amended) The method of claim 23 further including the step of removing
2 the water layer from the reaction vessel when the step of stripping the water and
3 water soluble impurities is ~~substantially~~ completed if the workpiece is positioned
4 below the water layer.

1 25. (Amended) A method of removing a surface component from a workpiece
2 surface comprising the steps of:
3 providing an etchant fluid;
4 providing at least one fluid immiscible with the etchant fluid having a different
5 density than the etchant fluid and forming a fluid interface therebetween;
6 positioning ~~the~~ a workpiece in the etchant ~~solution~~ fluid to facilitate etching of
7 ~~the~~ a surface component on the workpiece; and
8 terminating etching of the surface component when the workpiece is passed
9 through the fluid interface into the at least one fluid immiscible with the
10 etchant fluid.

1 26. (Amended) The method of claim 25 wherein the step of providing at least
2 one fluid immiscible with the etchant ~~solution~~ fluid comprises providing two fluids
3 immiscible with the etchant ~~solution~~ fluid, both fluids having a lower density than
4 the etchant ~~solution~~ fluid and immiscible with each other such that a first fluid
5 interface exists between the two fluids and the etchant ~~solution~~ fluid and a second
6 fluid interface exists between the two fluids.